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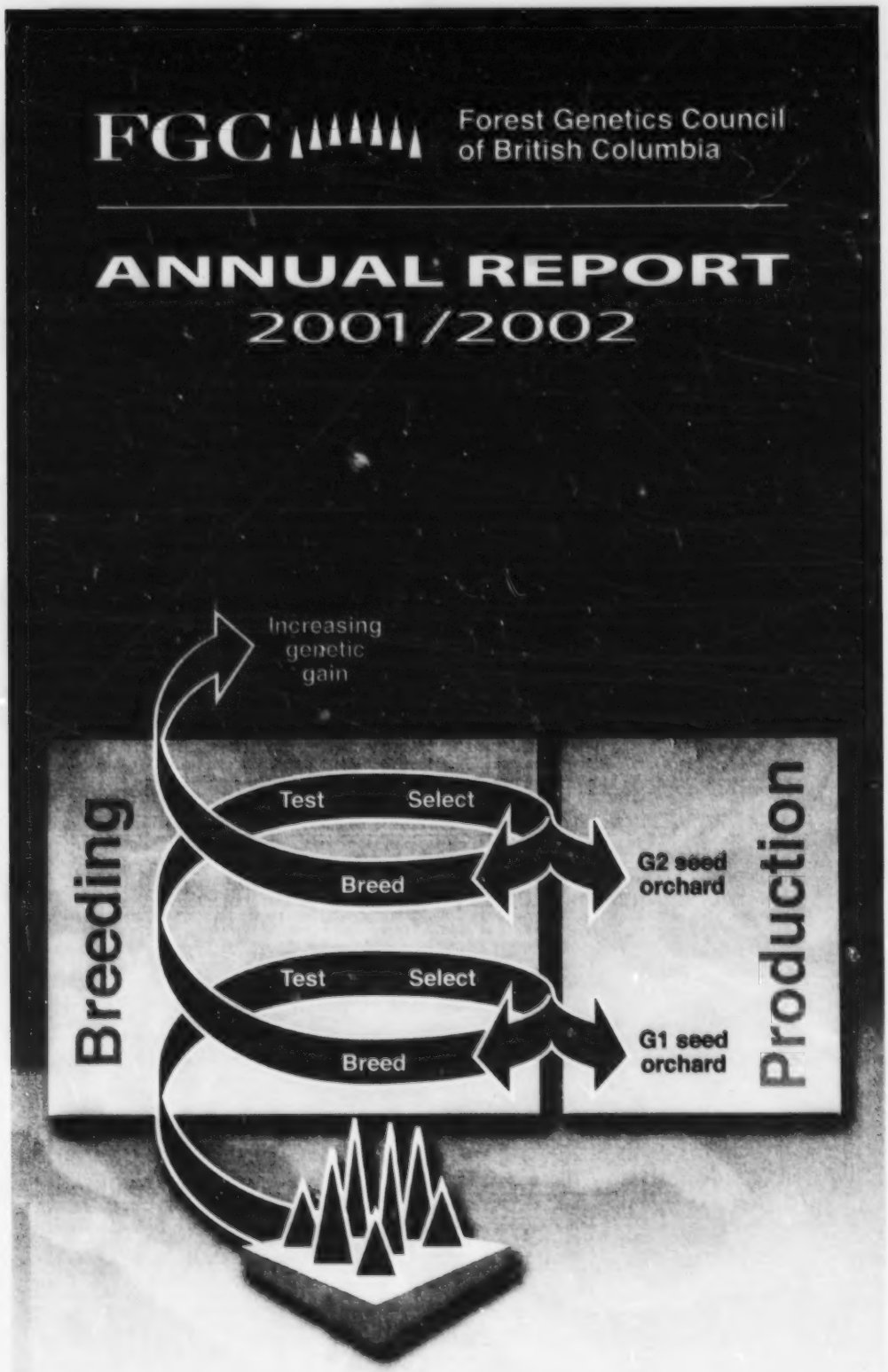
FGC Forest Genetics Council of British Columbia

ANNUAL REPORT 2001/2002



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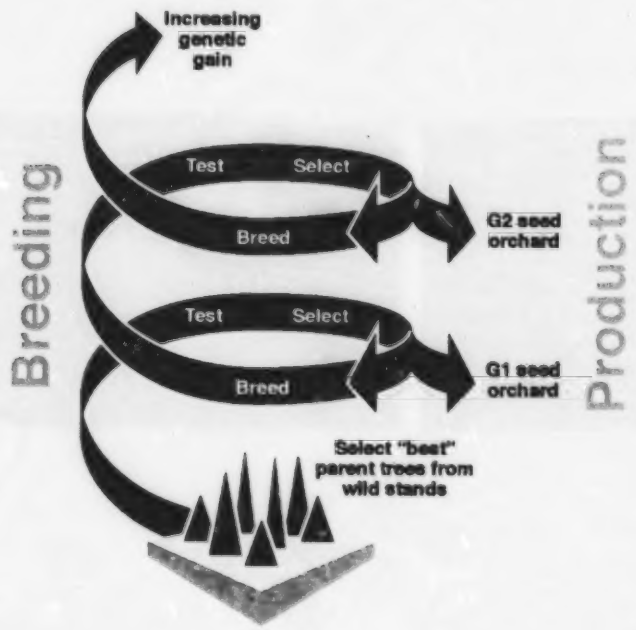
Cover Figure
Tree improvement is a continual process of selection, testing, and breeding to increase the extent to which each generation of improved seedlings exhibits desirable traits—the "genetic gain".

(from FGC Extension Note 2,
Biotechnology: Potential Applications in Tree Improvement)



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Acknowledgements

This Annual Report presents the 2001/02 achievements of the many people involved with tree improvement and forest genetics in British Columbia.

The members of the Forest Genetics Council and its four Technical Advisory Committees deserve credit for their careful deliberations and support. They are listed on the back page of this annual report.

The Chairs of the Technical Advisory Committees deserve special acknowledgement for their efforts. They are: Sally Aitken (Coastal TAC), Mike Carlson (Interior TAC), Dale Draper (Gene Conservation TAC), and Chris Hawkins (Extension TAC).

FGC Co-Chairs Shane Browne-Clayton and Dale Draper are thanked for their guidance throughout the year.

My appreciation also goes to Roger Painter (MOF Goals Agreement Program Administrator) and the FGC Secretariat.

Finally, my thanks and best wishes to staff of Forest Renewal BC as it ceases operations (Janet Gagne, Bob Konkin, and Alex Mackie).

JACK H. WOODS
PROGRAM MANAGER
FOREST GENETICS COUNCIL
OF BRITISH COLUMBIA

Photo credits:
Michael Carlson,
Annette Van Niejenhuis,
MoF Tree Improvement Staff

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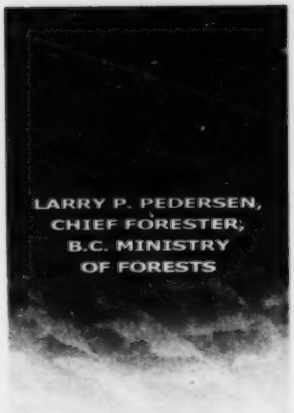
Message from the Chief Forester



LARRY P. PEDERSEN, CHIEF FORESTER, B.C. MINISTRY OF FORESTS

I am pleased to participate in the second annual report of the Forest Genetics Council of British Columbia. This report details tree improvement progress by performance goals and measures for the overall program and by subprograms.

Tree improvement, along with all other forestry disciplines in British Columbia, is facing many challenges. The closure of Forest Renewal BC and changes in government roles has reduced the funding and human resources available. Over the last five years, Council has worked to help the seed orchard industry become more self-reliant and market driven. The Ministry of Forests supports this direction and will be offering government seed orchards to the private sector during the coming year. I am confident that the desirability of investments in the use of select seed will result in a continued important role for tree improvement in this province.

I am pleased to see that the UBC Centre for Forest Gene Conservation is now fully functional. This Council initiative effectively leverages the talents of people and organizations in bringing attention to the provincial issues of genetic diversity and gene conservation, the integration of all facets of gene resource management, and the interface of forest genetics activities with forest products certification.

I want to re-iterate my belief that tree improvement is one of the better ways to enhance forest productivity in British Columbia, and seed orchards are the "engine" that provides this opportunity. The select seed produced from these orchards is the natural product of the genes of our best-performing native trees. British Columbia's licensed seed orchards and the seed derived from these seed orchards contain no genetically engineered materials. No genetically modified trees are registered for use in operational reforestation programs on Crown land in this province.

Council's programs are focused on delivering genetic gain at the level of seedlings being planted. The work of Species Committees in coordinating activities among breeding programs and orchard programs, the improved systems for ordering seed and tracking deployment, and the development of Web-based access to information for users are all examples. I am pleased to see the linkages developed between timber supply analysis and the use of select seed. These linkages are complex, and involve many aspects, including genetic worth ratings of seedlots, improved timber supply analysis methods to better integrate select seed use with timber flow predictions, and orchard developments that are based on the best available historic production data and seed use data.

The Forest Genetics Council continues to demonstrate that it is successfully providing strategic guidance and needed resources for the multi-faceted role of forest gene resource management in British Columbia. As Council begins a new round of strategic planning, I am confident that by working together, the interior and coastal forest industry, universities, and the Ministry of Forests will meet the many new forestry challenges that British Columbia is facing.

Message from Forest Genetics Council Co-Chairs

SHANE BROWNE-CLAYTON
INDUSTRY CO-CHAIR

DALE DRAPER
MINISTRY OF FORESTS
CO-CHAIR

Continued strong commitment by the interior and coastal forest industry, government, universities, and Forest Renewal BC has resulted in a well-organized provincial forest gene resource management program with strong leadership, clear objectives, inclusive planning processes, and performance-based management.

During the 2001/02 fiscal year, substantial progress was made in several areas:

- *The use of select seed in British Columbia increased substantially to 41% and average genetic worth (GW) increased to over 10%.*
- *SelectSeed Company Ltd. began developing 10 new seed orchards through tendering and contract processes. These orchards were all identified by the FGC planning process as required to meet Council objectives.*
- *The Centre for Forest Gene Conservation at the University of British Columbia became fully functional and, among other projects, led a collaborative effort on the relationship of tree improvement activities with forest products certification.*
- *The linkage between seed users and the tree improvement community was further strengthened through efforts to improve information access with initiatives such as Web-based seed planning, improvements to the Seed Planning and Registry system (SPAR), and through workshops and reports developed by the Extension and Communication Subprogram.*

The wind-up of Forest Renewal BC has created a great deal of uncertainty in forest genetics activities, and other areas of forestry. This important funding source allowed substantial advancement of tree improvement and forest genetics activities in the province. The Forest Renewal BC program also supported Council's efforts to implement a well-organized business planning process, which has allowed us to make a smooth transition in funding support to the new Forest Investment Account for the 2002/03 fiscal year. We thank Forest Renewal BC staff for their support over the last five years.

Forestry in British Columbia faces many challenges over the next several years as it responds to external forces such as the softwood lumber issue with the United States, and to internal changes resulting from government core review and downsizing. Meeting these challenges will require careful integration of forest genetics/tree improvement activities with other aspects of forestry. It will also require Council to review its objectives and ways of doing business. In 2002, the FGC will proceed with a strategic planning process to redefine objectives, roles, and ways of doing business.

With the strategy update and development of comprehensive annual business plans, we are confident that the forest genetics community will meet these challenges, and we look forward to continued cooperation and advancement in the coming year.

1.0 Forest Gene Resource Management in British Columbia

Forest gene resource management includes the conservation, controlled use, and enhancement of genetic resources of forest tree species.

Forest gene resource management encompasses the conservation, controlled use, and enhancement of genetic resources of forest tree species, and related communication and extension activities.

Forest gene resource management is a cooperative effort. The Forest Genetics Council of British Columbia (FGC, Council) coordinates a provincial forest gene resource management program that is implemented by stakeholders in the forest industry, Ministry of Forests (MOF), Canadian Forest Service (CFS), and universities.

During the term of this report, Forest Renewal BC was a major funding agency for forest gene resource management in British Columbia. Industry, MOF, and university cooperators contribute substantial in-kind, staff, and other resources.

In broad terms, the MOF leads tree breeding activities and private industry leads operational production of reforestation materials. The CFS, MOF Research Branch, and universities undertake research supporting tree improvement, while private institutions focus on applied research related to operational production. The University of British Columbia (UBC) leads gene conservation activities, with input from all cooperators.

This annual report describes progress on work outlined in the FGC Business Plan for 2001/2002. Most of this work was funded through the Forest Renewal BC Tree Improvement Program (TIP), which took direction from Council's strategic and annual business plans.

The report consists of five main sections. Section 1 presents an overview of the Forest Genetics Council and Forest Renewal BC TIP. Section 2 reports budgets, expenditures, and progress in Forest Renewal's TIP by key performance indicators. Section 3 describes provincial progress indicators. Section 4 summarizes cooperator activities. Section 5 highlights challenges facing Council in the year ahead.

1.1 Forest Genetics Council of British Columbia

> *The Forest Genetics Council represents the B.C forest industry, Ministry of Forests, and universities.*

The FGC is a multi-stakeholder group representing the forest industry, MOF, and universities. Council's mandate is to champion forest gene resource management, to oversee strategic and business planning for a cooperative provincial forest gene resource management program, and to advise the province's Chief Forester on policies related to forest gene resource management.

The Council provides a forum for stakeholder representatives to set goals and objectives, and to oversee the development and delivery of business plans to fulfill them.[1]

As set out in its 1998 Strategic Plan, Council's goal is:

To maximize the economic benefits from tree improvement investments for gains in wood quality, quantity, and pest tolerance consistent with strategic land use planning by:

- *managing a gene conservation program to maintain genetic diversity in commercial tree species*
- *identifying and funding the long-term production capability required to meet approved Business Plan priorities*
- *doubling the average volume gain of select[2] seed produced from 6% to 12% by 2007*
- *increasing select seed use to 75% of total provincial sowing by 2007*
- *monitoring progress in all aspects of gene resource management.*

Business Planning

> *Council's Technical Advisory Committees lay the groundwork for the annual FGC Business Plan.*

The annual FGC Business Plan outlines the activities and budgets of the seven subprograms that constitute the provincial forest gene resource management program.

FGC Technical Advisory Committees (TACs) provide technical and policy information to Council and contribute to the development of annual plans and associated budgets to achieve FGC goals and objectives (Figure 1).

- The Gene Conservation TAC (GCTAC) advises Council on issues related to gene conservation and genetic diversity, and identifies required activities and budgets.

[1] For more information on the Forest Genetics Council, see http://www.fgcouncil.ca

[2] "Select" describes seed and vegetative material having a level of genetic gain (GW > 0). All seed and vegetative lots derived from orchards and production facilities (genetic Class A) and superior provenances (genetic Class B+) are considered to be select.

- The Coastal and Interior TACs, through their Species Committees, prepare Species Plans that estimate seed demand, production capacity, and genetic gain for each of the 42 seed planning units (SPUs)[3] in the provincial forest gene resource management program.
- The Extension TAC (ETAC) advises Council on communication and extension issues, and develops an annual activity plan for the Extension and Communication Subprogram.
- The Seed Information Systems Steering Committee (SISSC) prepares plans and advises Council on investments in improved systems for registering seedlots, tracking seed use, and providing information on the use and availability of seed.

Each committee identifies priorities, and evaluates and ranks proposals and projects for funding through the Business Plan. Council reviews all strategies, plans, or recommendations from the TACs or other agencies for approval (or revision) before including them in the FGC Business Plan.

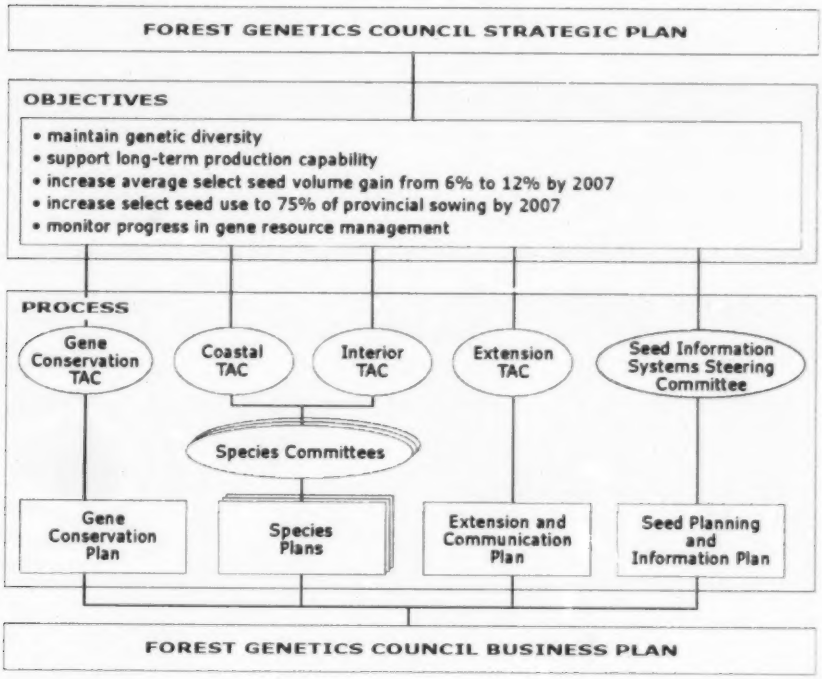

FOREST GENETICS COUNCIL STRATEGIC PLAN
OBJECTIVES
• maintain genetic diversity
• support long-term production capability
• increase average select seed volume gain from 6% to 12% by 2007
• increase select seed use to 75% of provincial sowing by 2007
• monitor progress in gene resource management
PROCESS
Gene Conservation TAC
Coastal TAC
Interior TAC
Extension TAC
Seed Information Systems Steering Committee
Species Committees
Gene Conservation Plan
Species Plans
Extension and Communication Plan
Seed Planning and Information Plan
FOREST GENETICS COUNCIL BUSINESS PLAN

Figure 1
The link between FGC objectives, planning processes, and the FGC Business Plan.

[3] Seed planning units are groupings by species, seed zone, and elevation band. They are logical units for the planning and management of tree breeding and seed production. Appendix 1 lists the 43 SPUs (42 for planning purposes) in the provincial forest gene resource management program that are targeted for investment in genecology, breeding, and orchard development.

1.2 Forest Renewal BC Tree Improvement Program[4]

> *Council's Business Plan and Forest Renewal's TIP are organized with the same subprogram structure.*

The Forest Renewal BC Tree Improvement Program (TIP) seeks to increase the growth rate, wood quality, and pest resistance of seedlings, and to preserve the genetic diversity of tree species across the province. Through its TIP, Forest Renewal BC invests in forest gene resource management activities that support its objectives and are incremental to existing government and industry activities.

TIP activities are organized into seven subprograms (Figure 2):

- Gene Conservation
- Tree Breeding
- Operational Tree Improvement (OTIP)
- Expansion of Orchard Seed Supply (SelectSeed Ltd.)
- Extension and Communication
- Seed Planning and Information Tools
- Administration

Funding

> *TIP annual budgets are based on recommendations from the Forest Genetics Council Business Plan.*

TIP annual budget allocations are based on recommendations from the FGC as developed in the FGC Business Plan, subject to Forest Renewal BC budgeting processes and approvals. Figure 2 illustrates the link between FGC strategic and business plans and the Forest Renewal TIP.

During the 2001/02 fiscal year, the Forest Renewal BC TIP funded forest gene resource management activities identified in the FGC Business Plan through three administrative mechanisms:

- Forest Renewal BC/University of BC Contribution Agreement
- Forest Renewal BC/Ministry of Forests Goals Agreement
- Forest Renewal BC/SelectSeed Company Ltd. Multi-Year Agreement

The subprograms associated with each of the agreements are shown in Figure 3.

[4] Forest Renewal BC was phased out March 31, 2002. Funding to continue the FGC provincial forest gene resource management program will come from the Forest Investment Account (FIA), established by the British Columbia Government.

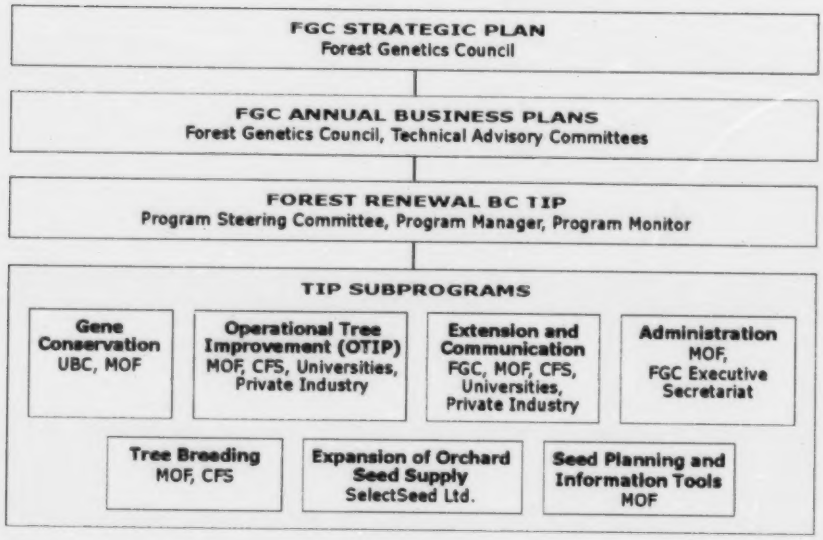


Figure 2
Relationship between FGC strategic and annual business plans, Forest Renewal BC TIP, and participants in various forest gene resource management activities.

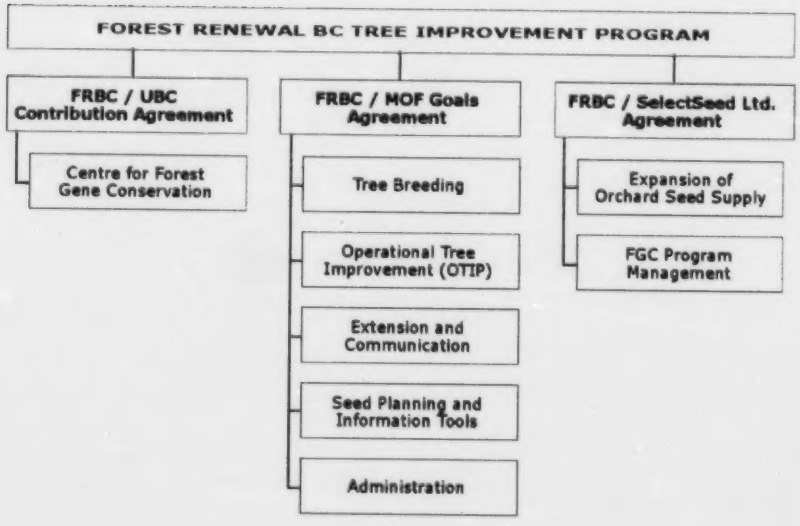

FOREST RENEWAL BC TREE IMPROVEMENT PROGRAM
FRBC / UBC Contribution Agreement
Centre for Forest Gene Conservation
FRBC / MOF Goals Agreement
Tree Breeding
Operational Tree Improvement (OTIP)
Extension and Communication
Seed Planning and Information Tools
Administration
FRBC / SelectSeed Ltd. Agreement
Expansion of Orchard Seed Supply
FGC Program Management

Figure 3
Funding agreements for the delivery of Forest Renewal BC TIP.

> *TIP activities are monitored for performance and progress towards long-term program objectives.*

Monitoring and Reporting

Activities undertaken in the delivery of the FGC Business Plan are monitored for performance relative to specified criteria, and for progress towards long-term program objectives. Performance is planned, monitored, and reported using key performance indicators (KPIs). These indicators are logical measures of work such as "number of grafts made" or "number of ramets planted." The types of work done under each subprogram are organized under a work breakdown structure (WBS) shown in Figure 4. KPIs are not feasible for all types of work, and reports are written for technical support, gene conservation, extension, communication, and administrative activities.

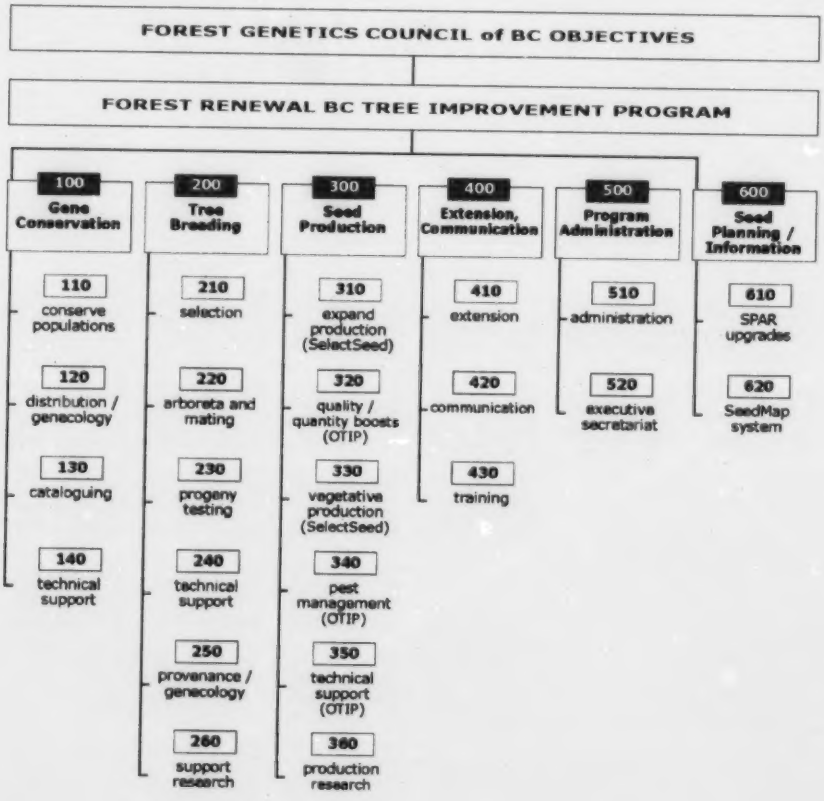


Figure 4
Work breakdown structure for program organization, management, and monitoring.

2.0 Forest Renewal TIP Progress 2001/02

2.1 Budgets and Expenditures

Forest Renewal BC financial allocations and expenditures for the 2001/02 fiscal year are shown in Table 1. The table does not include the in-kind, staff, and other substantial inputs by industry, MOF, and university cooperators that contribute to the success of the Tree Improvement Program.

Subprogram	Budget ($)	Expenditures ($)
Gene Conservation	250,000	204,369
Tree Breeding	2,450,000	2,303,730
Operational Tree Improvement (OTIP)	1,400,000	1,352,628
Expansion of Orchard Seed Supply (SelectSeed Ltd.)	1,232,000*	1,041,422
Extension and Communication	190,000	127,499
Seed Planning and Information Tools	287,000	289,000
Administration	340,000	336,214
Forest Renewal BC Tree Improvement Program Contribution	**$6,149,000**	**$5,654,862**

*$3,568,000 was targeted for a long-term fund to support orchard development.

Table 1
Summary of Forest Renewal BC TIP subprogram budgets and expenditures for the period April 1, 2001, through March 31, 2002

2.2 Gene Conservation Subprogram

Key to any forest genetic resource management program is the maintenance of genetic diversity to allow species to adapt to future biotic and abiotic challenges, and for genetic selection for new traits of economic interest in the future. Most of Council's gene conservation objectives are met through the Centre for Forest Gene Conservation (CFGC) in the Faculty of Forestry at the University of British Columbia. The CFGC has completed two years of a seven-year Gene Conservation Plan that includes developing effective strategies for conserving and monitoring genetic diversity, evaluating current levels of protection of genetic resources, and investigating levels and patterns of genetic diversity in native species.

Forest Renewal BC funded the first two years of the CFGC through a Contribution Agreement with the University of B.C. Funding for the third year has been secured from the Forestry Investment Account.

> *"Gene conservation activities ensure that genetic resources are maintained for future generations."*

Accomplishments of the CFGC in 2001/02 included:

- completion of a genetic marker study on the genetic diversity and mating system of whitebark pine populations in British Columbia
- completion of a project on the role of genetics in third-party forest certification internationally, including a workshop at UBC and the production of a report
- development of a Web site
- development of methodology and completion of the first phase of cataloguing the current degree of *in situ* protection of tree species in British Columbia
- prioritization of minor species for gene conservation research through (1) a literature review on the ecology and genetics of these species, (2) evaluation of current *in situ* protection (see previous), (3) an on-line survey to collect the field observations of foresters and botanists on the current status of these species, and (4) a meeting of experts at UBC to discuss and rank species
- initiation of a project developing marker-based methods of monitoring and managing co-ancestry in breeding populations
- substantial progress in collecting and analyzing field samples for a project on efficient sampling strategies for capturing rare alleles in *ex situ* collections.

"Project reports are available at www.genetics.forestry.ubc.ca/cfgc"

2.3 Tree Breeding Subprogram

"The Tree Breeding Subprogram seeks to continually improve the genetic worth of seed and vegetative materials for reforestation."

The Tree Breeding Subprogram seeks to continually improve the genetic worth (GW)[5] of seed and vegetative materials for reforestation. Tree breeding activities include selecting parents in wild stands, propagation, testing offspring, mating, establishing/maintaining/measuring trials, and associated research. The Tree Breeding Subprogram also includes applied genecology[6] to support the information needs of SPU programs as described in Species Plans. FGC Interior and Coastal TACs and their associated Species Committees carry out planning for the Tree Breeding Subprogram. The MOF Research Branch manages and undertakes Tree Breeding Subprogram activities.

Figure 5 indicates the allocation of effort to Tree Breeding Subprogram activities in 2001/02. Figure 6 compares the work completed under each activity to work planned for the fiscal year.

[5] Genetic worth is a measure of the genetic quality of a seed or vegetative lot over wild stand material, measured for a specific trait (e.g., growth, wood density, pest resistance).

[6] Genecology is the relationship between genetic diversity and environments.

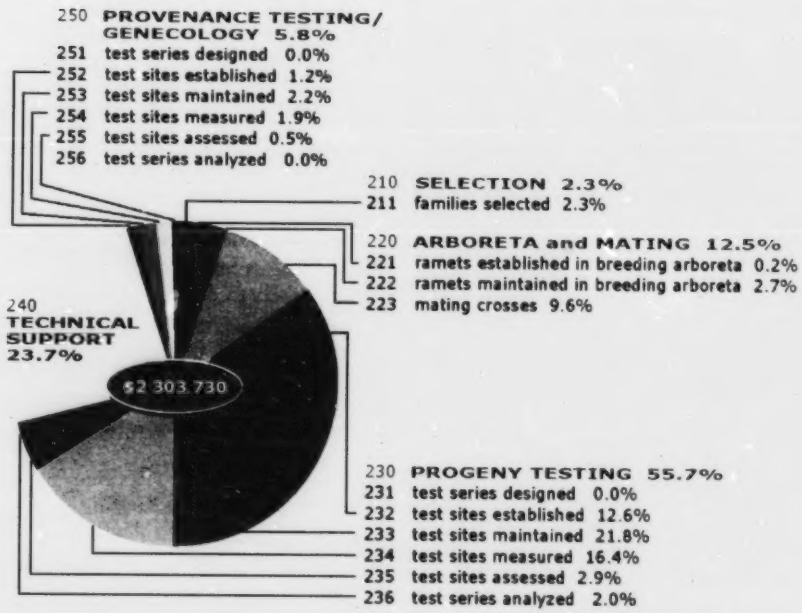

250 PROVENANCE TESTING/ GENECOLOGY 5.8%
251 test series designed 0.0%
252 test sites established 1.2%
253 test sites maintained 2.2%
254 test sites measured 1.9%
255 test sites assessed 0.5%
256 test series analyzed 0.0%
210 SELECTION 2.3%
211 families selected 2.3%
220 ARBORETA and MATING 12.5%
221 ramets established in breeding arboreta 0.2%
222 ramets maintained in breeding arboreta 2.7%
223 mating crosses 9.6%
240 TECHNICAL SUPPORT 23.7%
$2 303 730
230 PROGENY TESTING 55.7%
231 test series designed 0.0%
232 test sites established 12.6%
233 test sites maintained 21.8%
234 test sites measured 16.4%
235 test sites assessed 2.9%
236 test series analyzed 2.0%

Figure 5
Tree Breeding Subprogram allocation of effort, 2001/02.

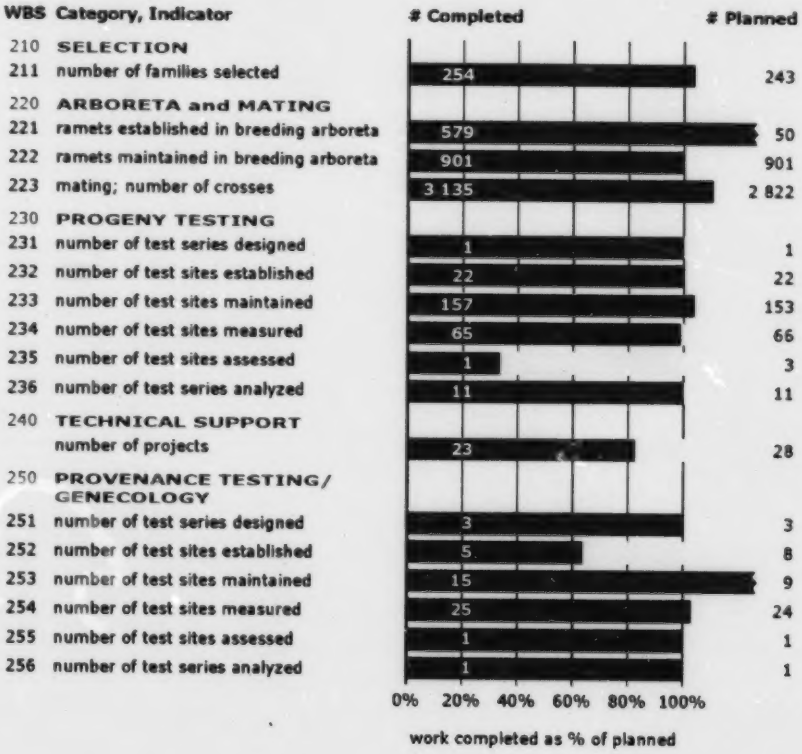

WBS Category, Indicator
Completed
Planned
210 SELECTION
211 number of families selected 254 243
220 ARBORETA and MATING
221 ramets established in breeding arboreta 579 50
222 ramets maintained in breeding arboreta 901 901
223 mating; number of crosses 3 135 2 822
230 PROGENY TESTING
231 number of test series designed 1 1
232 number of test sites established 22 22
233 number of test sites maintained 157 153
234 number of test sites measured 65 66
235 number of test sites assessed 1 3
236 number of test series analyzed 11 11
240 TECHNICAL SUPPORT
number of projects 23 28
250 PROVENANCE TESTING/ GENECOLOGY
251 number of test series designed 3 3
252 number of test sites established 5 8
253 number of test sites maintained 15 9
254 number of test sites measured 25 24
255 number of test sites assessed 1 1
256 number of test series analyzed 1 1
0% 20% 40% 60% 80% 100%
work completed as % of planned

Figure 6
Tree Breeding Subprogram progress, 2001/02.

Breeding programs test and select parent trees of high genetic quality for seed orchards.

Progress in Operational Breeding

Operational breeding program objectives were met or exceeded for most seed planning units (SPUs). Selection of families for seed orchards and breeding programs varied from initial plans, with additional selections made for coastal hemlock and high-elevation Douglas-fir, and fewer selections made for Sitka spruce. In the interior lodgepole pine breeding program, material for the large number of seed orchards being developed to meet seed supply objectives was identified and organized. This important work culminated long-term investments in first-generation progeny testing for most SPUs.

Technical Support

Technical support activities advance breeding programs and transfer breeding program gains to orchard production.

Twenty-three of the 28 projects planned were completed on schedule. These projects included work in areas such as realized-gain trials to correlate progeny test gains with area-based yield and with growth models, studies to determine the impacts of inbreeding on growth, research to better understand the mechanisms of pest resistance and the correlations among growth and resistance traits.

Realized-gain trials established in previous years for coastal Douglas-fir and western hemlock are verifying genetic gain predictions, and providing important information on interactions among site index, stand density, and inherent growth rate. Inbreeding studies with western redcedar are increasing understanding of the deleterious impacts of inbreeding on redcedar growth and diversity, and of how to avoid inbreeding in both orchard and wild-stand seed collections.

Realized-gain trials link tree improvement to growth and yield.

Provenance Testing and Genecology

Provenance testing and genecology work is primarily focused on SPUs where past testing was not done, or where it was insufficient to clearly determine where seed zone boundaries should exist. Some work may also identify superior provenances for seed collection.

Objectives in these categories were generally met. Tests of Pacific silver fir were established and measured to continue important work for this species. Other work with Douglas-fir in the submaritime seed zone is beginning to show patterns of genetic diversity, and has allowed decisions to be made concerning orchard development and seed movement. Projects with western redcedar and yellow-cedar have also progressed, leading towards decisions on elevation transfer, and on boundary location between the maritime and submaritime seed zones.

2.4 Operational Tree Improvement (OTIP) Subprogram

The OTIP Subprogram focuses on increasing the quality and quantity of select seed produced from existing forest company and MOF seed orchards. It also provides technical support to improve orchard production and management, including pest management.

OTIP funding is based on Species Plans—projects are developed through a call-for-proposals process based on Species Plan priorities. FGC Review Committees rank all proposals against FGC objectives and SPU priorities, based on technical merit, impact, value, and cost. The MOF Tree Improvement Branch administered the OTIP on behalf of Forest Renewal BC and the FGC.

Figure 7 shows the allocation of funding to OTIP Subprogram activities in 2001/02. Figure 8 compares the work completed under each activity to work planned for the fiscal year.

> *OTIP focuses on increasing the quality and quantity of seed produced from existing seed orchards.*

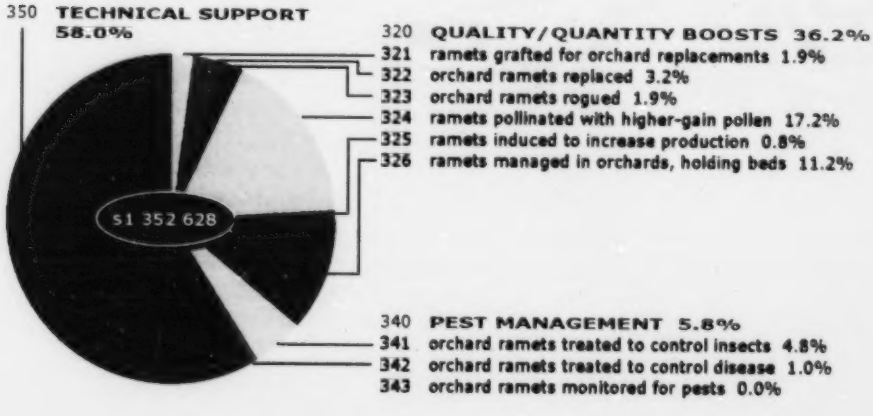

350 TECHNICAL SUPPORT
58.0%
$1 352 628
320 QUALITY/QUANTITY BOOSTS 36.2%
321 ramets grafted for orchard replacements 1.9%
322 orchard ramets replaced 3.2%
323 orchard ramets rogued 1.9%
324 ramets pollinated with higher-gain pollen 17.2%
325 ramets induced to increase production 0.8%
326 ramets managed in orchards, holding beds 11.2%
340 PEST MANAGEMENT 5.8%
341 orchard ramets treated to control insects 4.8%
342 orchard ramets treated to control disease 1.0%
343 orchard ramets monitored for pests 0.0%

Figure 7
OTIP Subprogram allocation of effort, 2001/02.

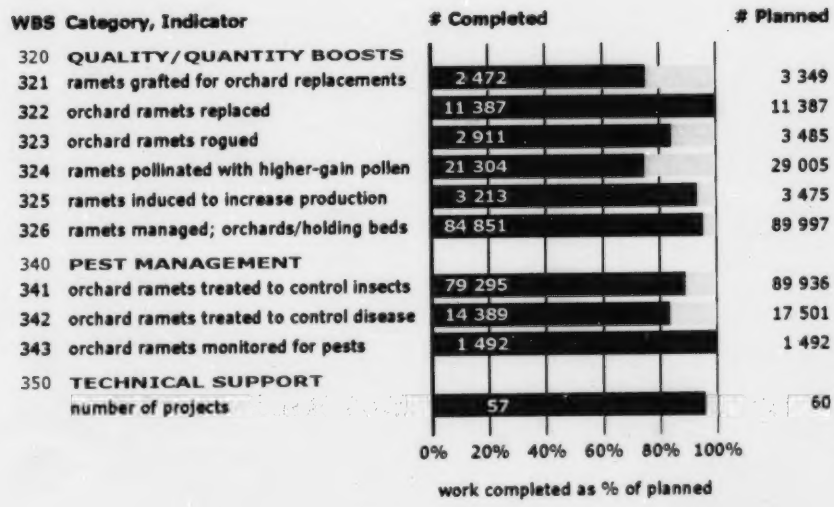


Figure 8
OTIP Subprogram progress, 2001/02.

> *Techniques to improve the genetic quality and quantity of orchard seed include introducing new selections from breeding programs, using high quality pollen, and inducing ramets to produce more reproductive buds.*

Quality/Quantity Boosts

Several techniques are used to improve the genetic quality or quantity of orchard seed. New selections from breeding programs are grafted for planting in seed orchards to replace the lower-gain ramets and improve the genetic worth of seed orchard seed. Supplemental mass pollination (SMP) and controlled pollination (CP) are used to apply high quality pollen to flowers to increase both seed production and genetic worth. Orchard ramets are induced through hormonal treatments or cultural treatments (i.e., girdling) to produce more reproductive buds. Seed-orchard and holding-bed ramets are managed to control crown growth and shape, and weeds, and to maintain identities. The following progress was made on specific activities during 2001/02.

WBS 321: 74% of grafting for the replacement of stock in existing orchards was completed as planned. One project was cancelled due to a lack of scion material for coastal white pine; this work will be done in future years.

WBS 322: 100% of orchard ramets were replaced as planned.

WBS 323: 84% of orchard roguing was carried out as planned. One interior spruce project was deferred until further information is available.

WBS 324: 73% of planned SMP and CP projects were carried out. Some projects (primarily interior spruce) were not undertaken due to lack of a flower crop this year.

WBS 325: 92% of planned ramet inducement of reproductive buds was completed. Treatments were deferred in one orchard because of the poor health of the ramets to be induced.

WBS 326: Nearly 85 000 ramets in orchards and holding beds (94% of planned) were managed to control crown growth and shape, control weeds, and maintain identities.

Pest Management

Insects and disease can damage cones or reduce the vigour and cone production of orchard ramets. Treatments to control insects and disease are only undertaken when needed. Orchard ramets are monitored for pest problems for early detection and effective control.

WBS 341: Over 79 000 ramets, representing 88% of those planned, were treated to control insects. Insect problems were less than anticipated and some treatments were cancelled.

WBS 342: Over 14 000 ramets (82% of planned) were treated to control disease. Some planned work was cancelled where disease problems did not materialize.

WBS 343: Some 1492 ramets (100% of planned) were monitored for insect and disease problems.

Technical Support

Seed orchard technical support projects are designed to remove barriers to producing seed of high quality for operational use.

WBS 350: Forty technical projects addressed priority issues, including seed-set problems in southern lodgepole pine orchards, pest control measures, pollen management to improve genetic worth and seed production, and orchard management techniques. This year saw the successful culmination of several years of intensive work to identify the causes of poor seed set in lodgepole pine in north Okanagan seed orchards and recommend appropriate actions. Based on this technical work, Council's Interior TAC concluded that the problems causing poor seed set in pine are controllable, and recommended the development of new lodgepole pine seed orchards in the north Okanagan to take advantage of strong and reliable cone production and no contaminating pollen.

> *"Technical support projects investigate ways to improve the production of high-quality seed."*

2.5 Expansion of Orchard Seed Supply Subprogram (SelectSeed Company Ltd.)

> *SelectSeed's primary mandate is to support seed orchard expansions needed to meet FGC objectives.*

Seed orchard expansions required to meet FGC objectives, and not undertaken by other companies or agencies, are done through SelectSeed Company Ltd. (SelectSeed), a corporation wholly owned by the B.C. Forest Genetics Society (Figure 9). SelectSeed also provides program management services to the FGC.

SelectSeed's Business Plan and investments are based on the long-term and annual business plans prepared by FGC TACs and Species Committees. Management discretion lies with the SelectSeed Board of Directors, and is guided by the terms of the multi-year agreement between SelectSeed and Forest Renewal BC. Orchard development agreements take the form of long-term contracts that provide stability for investment and management. The SelectSeed Business Plan is reviewed and approved annually by the FGC.

SelectSeed Mission Statement

SelectSeed supports Forest Genetics Council objectives for the development of seed orchard facilities to meet the provincial demand for high quality, ecologically adapted tree seed through investments, cooperative work with FGC members, and effective program management.

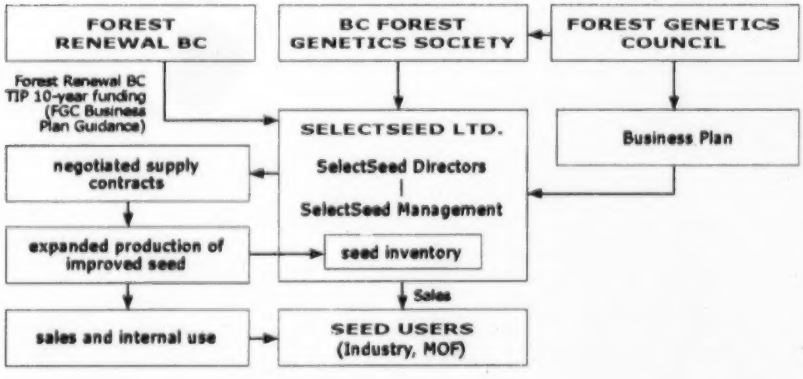


Figure 9
Organizational relationships between SelectSeed Ltd., Forest Renewal BC, Forest Genetics Council, and B.C. Forest Genetics Society.

Figure 10 shows funding allocations to Expansion of Orchard Seed Supply Subprogram activities in 2001/02. Figure 11 compares the work completed under each activity to work planned for the fiscal year.

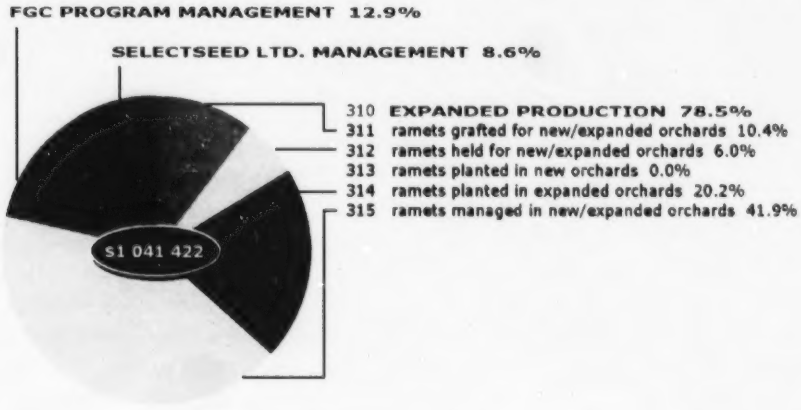

FGC PROGRAM MANAGEMENT 12.9%
SELECTSEED LTD. MANAGEMENT 8.6%
310 EXPANDED PRODUCTION 78.5%
311 ramets grafted for new/expanded orchards 10.4%
312 ramets held for new/expanded orchards 6.0%
313 ramets planted in new orchards 0.0%
314 ramets planted in expanded orchards 20.2%
315 ramets managed in new/expanded orchards 41.9%
$1 041 422

Figure 10
Expansion of Orchard Seed Supply Subprogram allocation of effort, 2001/02.

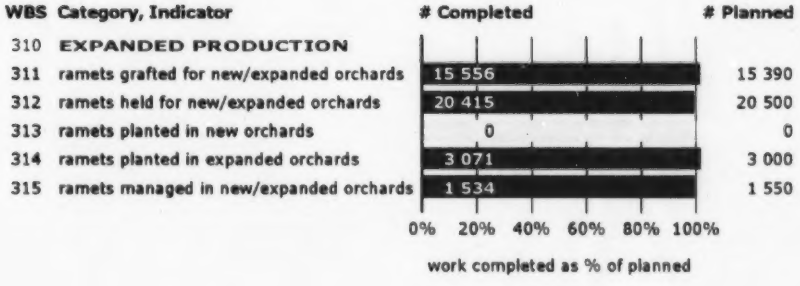

WBS Category, Indicator
Completed
Planned
310 EXPANDED PRODUCTION
311 ramets grafted for new/expanded orchards 15 556 15 390
312 ramets held for new/expanded orchards 20 415 20 500
313 ramets planted in new orchards 0 0
314 ramets planted in expanded orchards 3 071 3 000
315 ramets managed in new/expanded orchards 1 534 1 550
0% 20% 40% 60% 80% 100%
work completed as % of planned

Figure 11
Expansion of Orchard Seed Supply Subprogram progress, 2001/02.

Expanded Orchard Production

The expansion of orchard seed production capacity involves the propagation of selected parent trees through grafting, orchard site development, and the planting and management of grafted trees in orchards. These activities were done by SelectSeed on contract. All activities were undertaken to meet objectives in the FGC Business Plan.

Following the ITAC recommendation to establish lodgepole pine seed orchards in the north Okanagan area, SelectSeed initiated a request-for-proposal process that resulted in five long-term contracts for orchards that will supply seed to the Bulkley Valley low, Prince George low, Thompson Okanagan low and high, and Nelson low seed zones. These orchards will total 16 950 ramets and cover approximately 41 hectares.

SelectSeed awarded long-term orchard development contracts to expand five seed orchards: three for Douglas-fir (Nelson low, Prince George, and Quesnel Lakes) and two for interior spruce (Thompson Okanagan low and high elevation). These orchard expansions will total 5467 ramets.

The following activities were carried out in 2001/02 to develop materials for expanded and new seed orchards.

WB 311: 93% of the 15 556 grafts made during 2001/02 were for new lodgepole pine orchard development in the Prince George, Bulkley Valley, Central Plateau, Nelson, and Thompson Okanagan seed zones. Other grafts were made for interior Douglas-fir (Nelson zone), and interior spruce (Thompson Okanagan).

WBS 312: Some 20 415 ramets for new or expanded orchards were held at three different sites. Approximately 75% of these were new grafts, and 25% grafts from 1999 and 2000.

WBS 313: No ramets were planted in new orchards in 2001/02. Planting will begin in April 2002 for the five new lodgepole pine seed orchards in the North Okanagan.

WBS 314: All available stock – over 3000 ramets – was planted as planned.

WBS 315: Some 1534 ramets established in orchards prior to April 1, 2001 were managed this fiscal year.

> *"In its second year of operation, SelectSeed focused on planning, tendering, and negotiating long-term contracts for new lodgepole pine orchards."*

SelectSeed Ltd. Management

SelectSeed activities in 2001/02 included:

- organizing and managing contracts for the propagation and holding of stock
- developing orchard contracts, including bidding processes, contract negotiation, preparation of contract language, and records maintenance
- preparing an annual Business Plan covering business procedures, budgets, and long- and short-term activities
- reporting to Forest Renewal BC on accounts and activities
- managing accounts and corporate business.

FGC Program Management

FGC program management activities included developing the FGC Business Plan for 2001/02; organizing committee work for development of the 2002/03 FGC Business Plan; policy, committee, issue management, and reporting for the FGC; and financial management of the overall Forest Renewal BC TIP.

2.6 Extension and Communication Subprogram

The Extension and Communication Subprogram supports FGC goals and objectives through extension, communication, and education activities. These activities are developed and guided by the FGC Extension Technical Advisory Committee (ETAC), which includes representatives from government and industry seed orchards, forest companies, seed dealers, academia, researchers, and consultants. The ETAC prepares an annual activity plan to guide extension and communication activities. The plan forms the basis of an annual call for proposals in conjunction with the OTIP Subprogram call. Extension and communication contracts were administered by the MOF Tree Improvement Branch on behalf of Forest Renewal BC and the FGC.

Figure 12 shows funding allocations to the Extension and Communication Subprogram activities in 2001/02.

The Extension and Communication Subprogram supports FGC goals and objectives through extension, communication, and education activities.

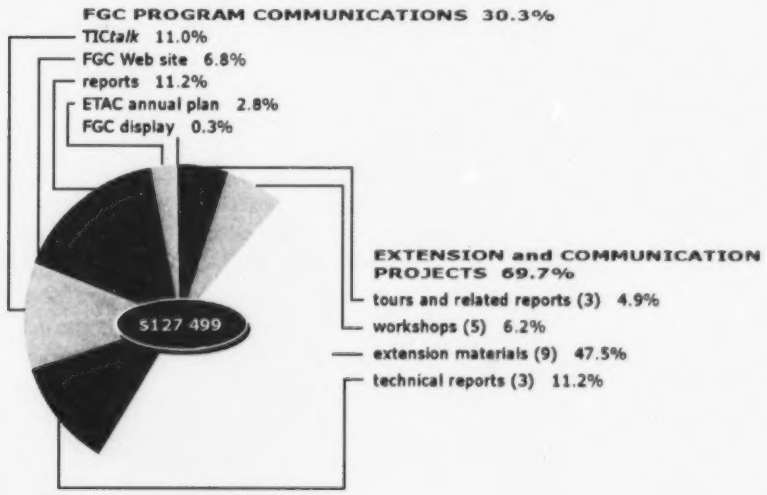


Figure 12
Extension and Communication Subprogram allocation of effort, 2001/02.

FGC Program Communications

FGC program communications focus on activities pertinent to the provincial forest gene resource management program. In 2001/02 these included the preparation of annual plans, reports, and display materials; maintenance of the FGC Web site; and production of TIC*talk*, Council's periodic newsletter. The FGC Secretariat carried out these program-level communication activities.

Extension and Communication Projects

FGC cooperators undertake a range of extension, communication, and education activities based on an annual plan and call for proposals.

"FGC cooperators delivered twenty extension and communication activities in 2001/02."

Extension activities provide technical information and training to users, specialists, and decision-makers. Communication activities develop and disseminate information to tree improvement and public audiences. The ETAC funded four types of extension and communication activities in 2001/02:

- *Workshops (5):* Three one-day seed workshops on how to order and acquire select seed and new nursery technologies. Two one-day workshops on provincial seed planning, policy, and programs in British Columbia. About 200 people, representing MOF regions and districts, consultants, and forest licensees, participated in the five workshops.
- *Tours and related reports (3):* A cross-section of 31 seed users attended a one-day field tour of research and demonstration installations; a report summary of tour questions, answers, and discussion was produced. A study investigating operational plantations to demonstrate the coastal Douglas-fir breeding program recommended establishment of a program of operational trials.
- Extension Materials (9):
  - outreach materials for use by Timber Supply Area committees: *Delivering Genetic Gain*, and a prototype *Seed Supply Profile for Golden TSA*
  - extension note, article, and frequently asked questions on *Benefits of Using Improved Reforestation Materials*
  - contribution to production of the *Seed Handling Guidebook*
  - contribution to *Field Guide to Reproductive Biology for Western White Pine*
  - first draft booklet on *The Reproductive Biology of Western White Pine*
  - display kiosk on tree improvement activities at the Cowichan Lake Research Station.
- *Technical Reports (3):* Technical reports were produced on topics of: incorporating genetic gain in timber supply analysis, assessing investments in tree improvement activities, and characteristics of inventoried seed for seed planning units.

2.7 Seed Planning and Information Tools Subprogram[7]

The Seed Planning and Information Tools Subprogram supports the development of computer-based information management and planning tools to improve client access to information on reforestation materials and provide clients with direct access to seed and other resource planning maps.

"The Seed Planning and Information Tools Subprogram develops computer-based information systems."

The Seed Information Systems Steering Committee (SISSC) develops Seed Planning and Information Tools activities and budgets. The Committee – comprised of MOF tree improvement, research, and systems staff, industry representatives and the FGC Program Manager – identifies projects and sets priorities for FGC approval. The Tree Improvement Branch administered the subprogram on behalf of Forest Renewal BC and the FGC.

Support for two Web-based systems projects, the Seed Planning and Registry system (SPAR) and SeedMap, continued in 2001/02. The MOF and Forest Renewal BC TIP jointly funded the SPAR Web-based application (Figure 13); SeedMap was solely funded by the MOF.

SPAR Web-based Application

The SPAR project will convert the existing mainframe application and database to a Web-based application. This upgrade will simplify access to SPAR; improve users' ability to screen seed availability; and assist clients in monitoring seed use, deployment, and genetic quality across the province.

Figure 13
Seed Planning and Information Tools Subprogram allocation of effort, 2001/02.

SeedMap

SeedMap is a Web-based mapping system that will provide direct access to seed planning maps and summary reports. With SeedMap, clients will be able to assess current and projected seed needs, and develop appropriate cone collection and seed supply access plans. SeedMap will also facilitate the integration of seed planning and tree improvement information (spatial and other) with initiatives such as land use planning, timber supply reviews, integrated silviculture planning, and forest certification programs.

[7] This subprogram, initially established to address the need for a SPAR systems upgrade within two years, has been extended indefinitely to allow for information management planning, development, and implementation over the longer term.

2.8 Administration Subprogram

"The Administration Subprogram provides administrative, financial, monitoring, and reporting services to Council and Forest Renewal BC's TIP."

The Administration Subprogram provided administrative, financial, monitoring, and reporting services to the FGC and to Forest Renewal BC. The administrative infrastructure for the Tree Breeding, OTIP, Extension and Communication, and Seed Planning and Information Tools subprograms was provided through the Forest Renewal BC/MOF Goals Agreement. The FGC Executive Secretariat, whose services are contracted through competitive bidding, supported Council's day-to-day business, communication, and planning activities.

Figure 14 shows the allocation of funding to Administration Subprogram activities in 2001/02.

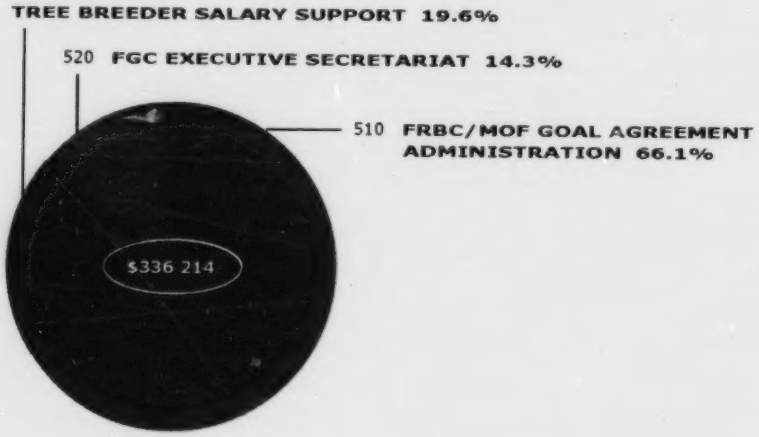

TREE BREEDER SALARY SUPPORT 19.6%
520 FGC EXECUTIVE SECRETARIAT 14.3%
510 FRBC/MOF GOAL AGREEMENT ADMINISTRATION 66.1%
$336 214

Figure 14
Administration Subprogram allocation of effort, 2001/02.

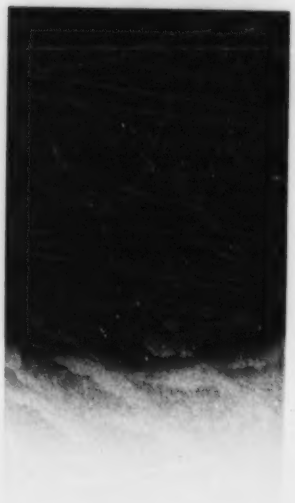
Forest Renewal BC/MOF Goals Agreement Administration

On behalf of the FGC and Forest Renewal BC, the Ministry of Forests provided administrative, financial, monitoring, and reporting services for the Tree Breeding, OTIP, Extension and Communication, and Seed Planning and Information Tools subprograms. These services included collecting and summarizing financial and performance reports from project proponents, and contributing to the planning and organization of FGC programs.

FGC Executive Secretariat

In 2001/02, FGC Executive Secretariat services included supporting three Council meetings and several TAC meetings, representing Council at other meetings, conducting Council and TAC votes by e-mail, managing issues, handling correspondence on Council's behalf, maintaining files on Council business, and assisting with organization and logistics throughout the year.

3.0 Provincial Progress Indicators



Two of Council's objectives are to increase the average volume gain (genetic worth for growth, or GWg) of select seed to 12%, and to increase select seed use to 75% of total provincial sowing by 2007. Figures 15 and 16 show, respectively, actual and forecast values for orchard seed/rooted cutting production and GWg for the period 1995–2020.[8]

Forecasts indicate that the FGC objective for GWg will be met by the 2007 target (Figure 16); however, projections for seed use (Figure 15) will not be met until about 2016.

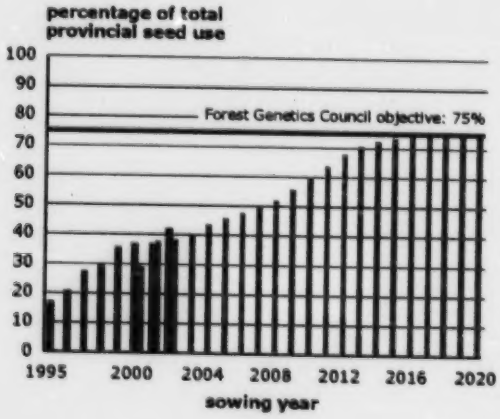


Figure 15
Historic and Species Plan forecasts of orchard seed production as percentage of provincial seed use.

■ actual
■ forecast

Sowing factor adjustments are included.

Production forecasts are adjusted to the year in which seed will be available for sowing (year of production plus two years). "Sowing years" run from July 1 to June 30; the 2003 sowing year begins July 1, 2002.

Historic seed production and genetic worth data are from the Seed Planning and Registry system (SPAR) operated by the MOF Tree Improvement Branch.

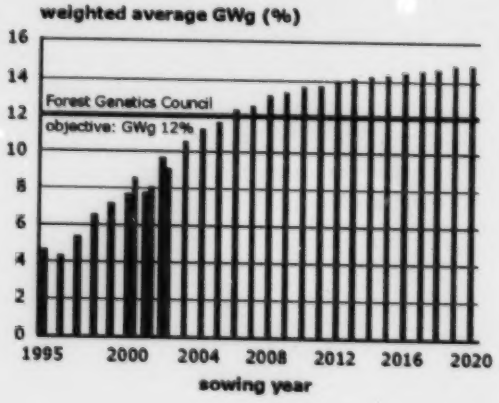


Figure 16
Actual and Species Plan forecasts of genetic worth for growth (GWg) of orchard seed.

[8] Until 2001, the term "select seed" referred to orchard seed with GW > 0. In 2001, the definition was expanded to include B+ seed (GW > 0). As a result, actual values in Figures 15 and 16 for 2000 and beyond include a small amount of B+ seed. All other values include only orchard seed.

During the 2002 sowing year, select seed use increased to 42% from 37% the previous two years (Figure 15). Most of this increase was due to higher availability of orchard seed for spruce and lodgepole pine in the Prince George and Bulkley Valley seed zones. Provincially, the use of orchard seed increased to 81.9 million from 72.1 million the previous year. The use of B+ (superior provenance) seed also increased, to 8.2 million from 7.2 million in 2001.

Projected use of orchard seed and rooted cuttings will fall short of the objectives set by the FGC in its 1998 Strategic Plan. This is primarily due to:

- young lodgepole pine seed orchards that will not produce within the anticipated time frame
- technical difficulties in several SPUs that are preventing or delaying the establishment or orchards and full programs (Ba M, Fdc SM, Sxs SM).

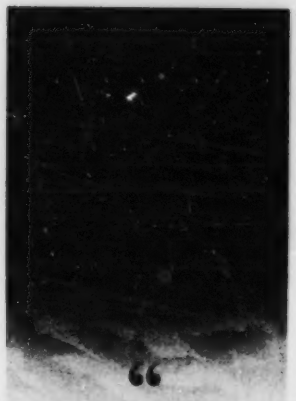
"Council's target of 12% average genetic worth will be achieved around 2007. Significant effort is needed to increase select seed use to 75% of total provincial sowing."

After 2007, the shortfall is caused principally by insufficient resources to initiate breeding programs (and, in time, seed orchards) for several high-elevation lodgepole pine SPUs (NE high, PG high, EK high). Planting in these SPUs totals approximately 8 million seedlings per year, about 6% of planned orchard production. Ongoing technical issues with Pacific silver fir Maritime zone (Ba M) are delaying orchard implementation, further reducing potential future seed production predictions by approximately 3 million. Without programs for these SPUs, the FGC objective of 75% is unlikely to be met.

Projections for the average GWg of orchard seed used are on target to meet FGC objectives by 2007 (Figure 16). This average GWg will continue to rise as old seed orchards are replaced with the best available selected material from breeding programs.

Substantial development of needed orchards during this reporting period, and planned developments during 2002/03 will provide sufficient orchard infrastructure to meet FGC objectives in most SPUs. When they begin seed production, new lodgepole pine orchards will meet the large needs throughout a number of interior SPUs. All new orchard development uses selected material from ongoing breeding programs, and will offer the largest amount of gain currently available within the constraints imposed by genetic diversity maintenance guidelines.

4.0 Cooperator Activities 2001/02



"Forest gene resource management is a cooperative endeavour involving the forest industry, two levels of government, universities, and consultants."

The provincial forest gene resource management program involves cooperators in the forest industry, two levels of government, universities, private research companies, and individual contractors (Table 2). Many of these groups participate in the work of the Council, its TACS, and Species Committees.

The Ministry of Forests is primarily responsible for tree breeding; the forest industry cooperates in identifying sites for progeny testing and with controlled matings. Private industry leads the operational production of reforestation materials; seven forest products companies, two private companies, and the provincial government own and operate seed orchards.

Under the direction of the FGC, SelectSeed Company Ltd. is substantially expanding seed orchard capacity. These expansions are all being done with the private sector through long-term contracts, with the sharing of resources and seed produced.

The CFS, MOF Research Branch, and universities undertake research supporting tree improvement, some of which was funded through the Science Council of BC and the Forest Renewal BC TIP.

Cooperators from industry, the MOF, and universities made substantial advancement on research into seed-set problems with lodgepole pine in north Okanagan seed orchards in 2001/02. Several key findings led to the development of management procedures that will increase seed set. This work also provided the technical basis for a recommendation from the Interior TAC to continue the establishment of lodgepole pine orchards in the north Okanagan area. SelectSeed acted on this recommendation with the tendering of contracts for five lodgepole pine seed orchards totalling 16 950 ramets.

The University of British Columbia (UBC) leads gene conservation activities through the UBC Centre for Forest Gene Conservation. The Centre is now fully operational.

Table 2
Cooperator participation in provincial forest gene resource management program.

Category	Name	Orchard	Breeding	Research	Tech. Support	Policy	Planning	Gene Conserv.	Extension	Education
Government	BC Ministry of Forests	•	•	•	•	•	•	•	•	•
	Canadian Forest Service		•	•						
Universities	Simon Fraser University			•	•					•
	University of British Columbia			•	•	•	•	•	•	•
	University of Northern BC			•	•	•	•	•	•	•
	University of Victoria			•	•				•	•
Societies	Southern Interior Forest Extension & Research Partnership								•	
Private Companies	Ainsworth Forest Products Ltd.					•	•			
	BC Research			•	•					
	Canadian Forest Products	•	•		•		•		•	•
	CellFor			•						
	Cortex Consultants Inc.								•	
	Glenviron Consulting								•	
	Isabella Point Forestry				•		•		•	
	Pacific Regeneration Technologies	•		•	•		•		•	
	Pope and Talbot Ltd.					•				
	Riverside Forest Products	•	•		•	•	•		•	•
	TimberWest Forest Corp.	•	•		•		•		•	•
	Vernon Seed Orchard Company[1]	•	•		•		•		•	•
	Western Forest Products	•	•		•		•		•	•
	Weyerhaeuser Canada				•		•		•	•
	Yellow Point Propagation	•	•		•		•		•	•
Contractors				•	•					

5.0 The Year Ahead

"In 2002/03, Council will update its 1998 Strategic Plan to set objectives that are economically feasible within a new forest industry business framework."

During 2001/02, the Forest Genetics Council faced many changes, which will continue into next year and possibly beyond as the forest industry in British Columbia adjusts to events such as U.S. softwood lumber protectionist tariffs, provincial government core review, a new Forest Practices Code, tenure change, and economic difficulties in the forest industry.

As of March 31, 2002, Forest Renewal BC ceased operations. During the past five years, Forest Renewal BC relied upon the FGC to set objectives and provide business planning and management to guide its tree improvement investments. This arrangement benefited tree improvement a great deal, and resulted in a business planning process that has increased program focus and relevance to users. With the introduction of the Forest Investment Account (FIA) to support investments on public lands, the FGC successfully worked with Forest Renewal BC and provincial government staff to establish a tree improvement program within the FIA. As with Forest Renewal BC funding, Council will provide program objectives and business planning, and the Ministry of Forests will administer FIA funds. The transition from Forest Renewal BC to FIA support is expected to happen with little disruption to programs.

Specific challenges in the year ahead include:

- **Strategic Planning**

  The 1998 FGC Strategic Plan provided a solid foundation for program development and progress. Many components of this plan remain relevant, but new information, and a changing forest sector require a new round of strategic planning to set a course of action over the next five-year period. During 2002, a subcommittee of the FGC will lead this process. Council will be challenged to develop new objectives and new roles, planning structures, and funding sources that will allow these objectives to be met.

- **Privatization of MOF Seed Orchards**

  During 2002/03, the Ministry of Forests intends to privatize its seed orchard operations. These orchards constitute approximately 40% of the orchard capacity in British Columbia, and are very important to meeting FGC objectives for the supply of orchard seed. The decision to privatize the orchards is consistent with the 1998 FGC Strategic Plan, which indicates a private sector role in orchard seed production. Disposition of the orchard operations will be a critical transition for tree improvement in the province, and the FGC role in this transition will be important to meeting long-term objectives.

> *Forest gene resource management is most efficient when done cooperatively. Collaborative effort will help B.C. meet the challenges of its changing business environment.*

- **Breeding Program Support**

  Provincial government core review and downsizing is increasing pressure on breeding programs. The FGC Strategic Plan places responsibility for breeding programs with the Ministry of Forests, but budget pressures are making it increasingly difficult for the ministry to fulfill this mandate. As other changes in the forest sector play out during the next two years, the FGC and the MOF will be challenged to find a long-term, effective solution to maintaining the breeding programs.

- **Forest Practices Code, Tenure Changes**

  In late 2001, the B.C. government began discussions about changes to the Forest Practices Code and to tenure. These changes will impact the regulatory framework and the economic incentives associated with tree improvement and the use of select seed by licensees on Crown lands. In 2002/03, Council will be challenged to contribute to these policy and planning decisions.

Appendix 1: Seed Planning Units

Seed planning unit (SPU)				
#	Species	Seed zone symbol	Seed zone name	Elevation band (m)
1	Fdc	M	Maritime	< 700
2	Cw	M	Maritime	< 600
3	Hw	M	Maritime	< 600
4	Sx	NE	Nelson	< 1300
5	Sx	NE	Nelson	1000-1500
6	Ss	M	Maritime	> 1500
7	Pli	NE	Nelson	< 1400
8	Pw	M/SM	Maritime/Submaritime	< 1000
9	Ba	M	Maritime	< 1000
10	Pli	TO	Thompson Okanagan	< 1400
11	Yc	M	Maritime	< 1200
12	Pli	PG	Prince George	< 1200
13	Lw	NE	Nelson	< 1300
14	Sx	PG	Prince George	< 1200
15	Pw	KQ	Kootenay Quesnel	< 1400
16	Pli	TO	Thompson Okanagan	> 1400
17	Pli	BV	Bulkley Valley	< 1200
18	Pli	CP	Central Plateau	< 900 N of 56°; < 1100 S of 56°
19	Fdc	SM	Submaritime	200-1000
20	Pli	NE	Nelson	> 1400
21	Fdi	NE	Nelson	< 1000
22	Fdi	NE	Nelson	> 1000
23	Sx/Ss	SM/NST	Submaritime/Nass Skeena Transition	all
24	Hw	M	Maritime	> 600
25	Sx	EK	East Kootenay	< 1700
26	Pli	PG	Prince George	> 1200
27	Cw	SM	Submaritime	200-1000
28	Sx	TO	Thompson Okanagan	1300-1850
29	Pli	EK	East Kootenay	> 1500
30	Sx	TO	Thompson Okanagan	< 1300
31	Fdc	M	Maritime	> 700
32	Pli	EK	East Kootenay	< 1500
33	Cw	M	Maritime	> 600
34	Lw	EK	East Kootenay	800-1500
35	Sx	BV	Bulkley Valley	< 1200
36	Bg	M	Maritime	< 700
37	Fdi	QL	Quesnel	< 1200
38*	Hw	M	Maritime	> 600
39	Fdi	EK	East Kootenay	all
40	Sx	PR	Peace River	650-1200
41	Fdi	PG	Prince George	< 1000
42	Sx	PG	Prince George	> 1200
43	Fdi	CT	Cariboo Transition	< 1100

* SPU 38 has been merged with SPU 3 for planning purposes

Forest Genetics Council of BC

Name	Affiliation	Representing
Shane Browne-Clayton	Riverside Forest Products	Industry Co-Chair
Dr. Dale Draper	Ministry of Forests	Ministry of Forests Co-Chair
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Dr. John Barker	University of BC	Coast industry
Henry Benskin	Ministry of Forests	Forestry Division, Research Branch
Dr. Michael Carlson	Ministry of Forests	Interior Technical Advisory Committee
Janet Gagne	Forest Renewal BC	Forest Renewal BC
Dr. Chris Hawkins	University of Northern BC	University
Mark Hopkins	Ainsworth Forest Products	Interior industry
Art Lacourciere	Weldwood Canada	Interior industry
Diane Medves	Weyerhaeuser Canada	Coast industry

Coastal Technical Advisory Committee

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Dr. David Cyr	Cellfor Ltd.	Larry Sigurdson	Ministry of Forests
Dr. John King	Ministry of Forests	Dr. Michael Stoehr	Ministry of Forests
David Kolotelo	Ministry of Forests	Annette van Niejenhuis	Western Forest Products
Diane Medves	Weyerhaeuser	Dr. Alvin Yanchuk	Ministry of Forests
Don Pigott	Yellow Point Propagation		

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David Basaraba	Crestbrook Forest Industries	Tim Lee	Vernon Seed Orchard Co.
Shane Browne-Clayton	Riverside Forest Products	Mike Madill	Ministry of Forests
Keith Cox	Ministry of Forests	Russ Martin	Canadian Forest Products
Nola Daintith	Ministry of Forests	Anna Monetta	Ministry of Forests
Mark Faliszewski	Ministry of Forests	George Nicholson	Riverside Forest Products
Hilary Graham	Pacific Regeneration Technologies	Gerry Pinkerton	Ministry of Forests
Terry Hammond	Pope & Talbot	Chris Walsh	Ministry of Forests
Dr. Chris Hawkins	University of Northern BC	Joe Webber	Ministry of Forests
Barry Jaquish	Ministry of Forests	Kim Young	Tolko Industries

Extension Technical Advisory Committee

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Charlie Cartwright	Ministry of Forests	Doug Stables	Western Forest Products
Keith Cox	Ministry of Forests	Don Summers	Ministry of Forests
Tim Crowder	TimberWest	Kathie Swift	SIFERP
Peter Forsythe	The Pas Lumber	Dave Trotter	Ministry of Forests
Diane Gertzen	Ministry of Forests	Eric van Steenis	Ministry of Forests
Lauchlan Glen	Glenviron Consulting	Dr. Joe Webber	Ministry of Forests
Melissa Hadley	FGC Secretariat	**Alternates**	**Affiliation**
Tim Lee	Vernon Seed Orchard Company	Jordan Tanz	FGC Secretariat
George Nicholson	Riverside Forest Products	Steve Thorpe	Canadian Forest Products

Gene Conservation Technical Advisory Committee

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Jack Woods	SelectSeed Ltd.
Dr. Alvin Yanchuk	Ministry of Forests
Dr. Cheng Ying	Ministry of Forests